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Directory of FOREST GENETIC ACTIVITIES in the South

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CONTENTS

FOREWORD

This publication was prepared in cooperation with the Committee on Southern Forest Tree Improvement. It is the purpose of this committee to: (1) advise and assist those interested in the improvement of southern forest trees in arranging and conducting research and development programs; (2) provide a clearing house for information on forest tree improvement; (3) provide for or assist in coordination in the conduct of a South-wide program of tree improvement research and development; and (4) foster and encourage the advancement of knowledge of southern tree genetics. The present publication lists, characterizes, and locates work now in progress in the South; it was compiled from information given by organizations working in the field.

Subcommittee on Tree Selection and Breeding

D. A. Anderson--Texas Forest Service
Woolford B. Baker--Emory University
Spencer Chase--Tennessee Valley Authority
C. C. Doak--Agricultural and Mechanical College of Texas
Ellwood S. Harrar--Duke University
Paul H. Harvey--North Carolina State College
C. M. Kaufman--University of Florida
Scott S. Pauley--Maria Moors Cabot Foundation for Botanical Research
Maxon Y. Pillow--Forest Products Laboratory
F. I. Righter--California Forest and Range Experiment Station
Ernst J. Schreiner--Northeastern Forest Experiment Station
Bratislav Zak--Bureau of Plant Industry, Soils and Agricultural Engineering
Bruce Zobel--Texas Forest Service
Keith W. Dorman--Southeastern Forest Experiment Station (Chairman)

Previous publications and reports prepared in cooperation with the Committee on Southern Forest Tree Improvement are:

1. Report of the first southern conference on forest tree improvement. Atlanta, Ga., January 9-10, 1951. Mimeographed. U. S. Forest Service, Atlanta, Ga.

2. Proposal for a cooperative study of geographic sources of southern pine seed. Subcommittee on Geographic Source of Seed, Philip C. Wakeley, Chairman. Mimeographed. Southern Forest Experiment Station, New Orleans, La. Oct. 25, 1951.

3. Standardized working plan for local tests of seed source. Subcommittee on Geographic Source of Seed, Philip C. Wakeley, Chairman. Mimeographed. Southern Forest Experiment Station, New Orleans, La. Oct. 25, 1951.

4. Hereditary variation as the basis for selecting superior forest trees. Keith W. Dorman, Chairman, Subcommittee on Tree Selection and Breeding. Southeastern Forest Experiment Station, Station Paper No. 15. March 1952.

DIRECTORY OF FOREST GENETICS ACTIVITIES IN THE SOUTH

by

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To many people, forest genetics means controlled breeding. This is only one phase of the work. There must be a program of plant introduction to test foreign species for adaptability to local conditions. Also, races, strains and varieties of each local species must be studied before the best breeding material is found. There are problems in techniques to be solved such as those in testing progeny of selected trees or the hybrids. Also, methods of propagating by vegetative means are needed for trees used as breeding stock or those of superior varieties. These are but a few of the phases of forest genetics work, but they and many others are necessary before attaining the objective--better forest trees.

Formal research in forest genetics is relatively new in the South. Some studies have been made of racial variation in important species, and foreign species have been introduced on a small scale. Also, some of the hybrids produced by the Institute of Forest Genetics are being tested. However, selection and controlled breeding have been started only recently. The lists of studies on the following pages are impressive, and indicate wide and active interest in the improvement of forest trees. But much additional research will have to be undertaken if we are to make the most of the existing opportunities for genetic improvement of southern forest trees.

1/ Chairman, Subcommittee on Tree Selection and Hybridization of the Committee on Southern Forest Tree Improvement.

PLANT-INTRODUCTION STATIONS, ARBORETUMS, AND BOTANICAL GARDENS

Collection of tree species, varieties, and forms in as wide a field as possible is one of the first steps in the development of better forest trees. This is the raw material with which the tree breeder works to create new types or from which he selects those better suited for particular purposes. Arboretums and botanical gardens are the storehouses for breeding material and they are of great importance to the geneticist. Plant introduction workers stock the storehouses and provide a source of raw material that is greatly beyond the means of the average tree breeder. Arboretums and botanical gardens in the South are neither well developed nor well distributed geographically to meet the needs of a broad tree improvement program. Additional stations are needed in the great timber producing regions of the coastal plain and upland areas from the Carolinas to Louisiana. The following list gives arboretums, botanical gardens, and plant introduction stations now established in the South.

Coker Arboretum, Chapel Hill, N. C.

Blandy Experimental Farm Arboretum, Boyce, Va.
Established 1927. 100 acres.
Chief function: experimental and research, educational laboratory for graduate students.
Featuring: evergreens, woody trees, and shrubs, conifers in general, Pinus, Berberis, Phlox, Buddleia, and Quercus.

Fairchild Tropical Garden, Coconut Grove, Fla.
Established 1938. 83 acres.
Chief function: to grow all the plant material, both native and exotic, which will thrive in this area.
Featuring: palms and other tropical trees, vines and shrubs adaptable to south Florida.

McIlhenny Arboretum, Avery Island, La.
Established 1900. 300 acres.
Chief function: park and bird sanctuary.
Featuring: evergreens, woody trees, and shrubs.

Tennessee Valley Authority, Norris, Tenn.
Established 1936. 100 acres
Chief function: research.

Texas Forest Service, College Station, Texas
Established 1952. 50 acres
Chief function: research.
Featuring: Mexican and southwestern pines.

U. S. Dept. of Agriculture Plant Introduction Garden, Chapman Field, Perrine, Fla.

U. S. Dept. of Agriculture Plant Introduction Station, Griffin, Ga.

University of Florida Subtropical Experiment Station, Homestead, Fla.
Established 1930. 170 acres.
Chief function: research.

PLANTINGS OF INTRODUCED SPECIES OF FOREST TREES[2/]

The plant breeder must in most instances select breeding stock from among a large number of species. He needs accurate data for tree growth under different climatic and soil conditions, information on resistance or susceptibility to fungi and insects common to the area, and information on tree quality for lumber or other products. Another important consideration is that species or races and varieties of species with wide geographical distribution may be well suited for planting in certain areas and perform better than local species. Only by test plantings can the good prospects be sorted out from the poor ones. Planting of foreign species has been undertaken on a small scale in the Appalachians mountains, southern Florida. and Texas, but little has been done in the Coastal Plain, Piedmont, Ozark mountains, and other areas of the South.

Bent Creek Experimental Forest, Asheville, N. C.
Thuja occidentalis. New York. 1926
Acer saccharum. New York. 1926
Pinus resinosa. Vermont, Michigan, Minnesota. 1926
P. monticola. 1927
P. contorta. 1927
P. densiflora. Japan. 1928
P. nigra var. *poiretiana*. Indiana. 1928
P. sylvestris. Belgium. 1926
P. koraiensis. Korea. 1929
P. radiata. France. 1929
P. sabiniana. California. 1930
P. rigida var. *serotina*. North Carolina. 1920
P. attenuata. California. 1930
P. pungens. North Carolina. 1930
P. contorta var. *murrayana*. California. 1930
P. taeda. North Carolina. 1930
P. caribaea. Louisiana. 1927

2/ The tree names are listed as reported by various agencies and may not follow the same system of nomenclature. However, the spelling has been changed in some instances to conform with that given in Standardized Plant Names, 2nd edition.

Pinus palustris. North Carolina. 1929
Libocedrus decurrens. Washington. 1927
Picea sitchensis. 1927
P. glauca. 1927
Abies concolor. California. 1930. Colorado. 1926
Chamaecyparis thyoides. Virginia. 1927
Chamaecyparis lawsoniana. California. 1930
Larix leptolepis. Japan. 1928
L. occidentalis. 1930
Cornus mas. France. 1929
C. sanguinea. France. 1929
Ginkgo biloba. Washington, D. C. 1929
Albizzia julibrissin. 1929
Gleditsia triacanthos. 1929
Pseudotsuga taxifolia. 1929
Cercis canadensis. 1929
Castanea mollissima. 1929
C. crenata. 1929
C. sanguinni. 1929
C. dentata. 1929
Cupressus macnabiana. California. 1930
Fraxinus oregona. Oregon. 1930
Metasequoia glyptostroboides. China. 1950

Coker Arboretum, University of North Carolina, Chapel Hill, N. C.

Acer palmatum
Aesculus hippocastanum
Ailanthus altissima
Albizzia julibrissin
A. lebbek (= A. kalkora)
Aralia chinensis
Broussonetia papyrifera
Cephalotaxus drupacea
Clerodendron trichotomum
Cryptomeria japonica
Cunninghamia sinensis
Fontanesia fortunei
Ginkgo biloba
Juglans sieboldiana
Juniperus communis var. hibernica
Koelreuteria paniculata
Lagerstroemia indica
Libocedrus decurrens
Magnolia denudata
M. soulangeana
Osmanthus aquifolium
O. fragrans
Paulownia tomentosa
Picea orientalis
Pinus australis
Pistacia chinensis
Podocarpus macrophyllus
Prunus sieboldi
Quercus glauca
Sterculia platanifolia
Styrax japonica
Thuja orientalis
Tilia europaea
Zizyphus jujuba
Z. jujuba var. lang.
Cercis chinensis

Florida Board of Forestry, Tallahassee, Fla.
Many tropical hardwood and softwood species planted at Highland Hammock State Park, Sebring, Fla.

Forestry Department, Alabama Polytechnic Institute, Auburn, Ala.
Cupressus arizonica. 1949

Georgia Agricultural Experiment Station, Experiment, Ga.

Pinus pseudostrobus. 1950
P. douglasiana
P. cembroides
P. strobus var. chiapensis
P. ayacahuite
P. nelsoni
P. oocarpa
P. ayacahuite var. brachyptera. 1949
P. micheasana var. cornuta
P. hartwegi
P. engelmanni
Taxodium mucronatum

Ida Cason Callaway Foundation, Hamilton, Ga.

Abies religiosa. Mexico. 1951
Pinus ayacahuite. Mexico. 1951
P. pinaster. Portugal. 1951
P. strobus. North Carolina. 1951
P. hartwegi. Mexico. 1951
P. cembroides. Mexico. 1951
P. strobus var. chiapensis. Mexico. 1951
P. lambertiana. Arnold Arboretum. 1951
P. pseudostrobus. Mexico. 1951
P. bungeana. Arnold Arboretum. 1951
P. nelsoni. Mexico. 1951
Crataegus mexicana. Mexico. 1951
Taxodium mucronatum. Mexico. 1951
Cupressus (standleyi). Mexico. 1951
Platanus mexicana. Mexico. 1951
Chilopsis linearis. Arizona. 1951
Cedrus libani. Arnold Arboretum. 1951
Widdringtonia dracomontana. South Africa. 1951
W. cuppressoides. South Africa. 1951
W. schwarzi. South Africa. 1951

North Carolina Dept. of Conservation and Development, Division of Forestry, Raleigh, N. C.

Pinus pinaster. Fort Macon, N. C. 1929
P. pinaster. Nags Head, N. C. 1948
Asiatic chestnut, Nanking strain. Holmes Nursery, Penrose, N.C. 1945

Oklahoma Agricultural Experiment Station and Oklahoma State Division of Forestry, Oklahoma City, Okla.

Pinus thunbergi. Central and western Oklahoma. 1940 to 1950
P. densiflora. " " " " " " "
P. massoniana " " " " " " "
Russian mulberry. Woodward, Okla.
Chinese elm " "
Parvifolia elm " "
(many others)

Pisgah National Forest, Asheville, N. C.

Picea abies. 1925
P. glauca. 1924
P. engelmanni. 1926
P. sitchensis. Washington. 1931
Pinus densiflora. 1924
P. contorta. 1926
P. thunbergi. 1923
P. resinosa. Minnesota. 1926
P. sylvestris. Belgium. 1926
P. monticola. Idaho. 1923
Thuja occidentalis. Ontario, Canada. 1926
Pseudotsuga taxifolia. Montana. 1923
Larix leptolepis. Japan. 1924
L. decidua. 1924
Abies concolor. 1927
Thuja plicata. British Columbia. 1930
Abies alba. 1924

South Carolina National Forest, Columbia, S. C.

Sequoia, sp. Enoree Ranger District. 1900
Cryptomeria, sp. Enoree Ranger District.

Tennessee Valley Authority, Norris, Tenn.

Carya spp.
Castanea mollissima
C. crenata
C. henryi
Diospyros kaki
Morus spp.
Juglans nigra
J. regia
J. sieboldiana
J. cincerea
(Juglans hybrids)
Populus alba
P. tremuloides
(Populus hybrids)
Quercus acutissima
Q. leucophylla
Robinia pseudoacacia (straight-stem selections)

Texas Forest Service, College Station, Texas

Pinus pumila
P. griffithi
P. chihuahuana
P. douglasiana
P. pinea
P. cembroides
P. ayacahuite var. veitchi
P. leucodermis
P. pseudostrobus
P. bungeana
P. patula
P. nelsoni
P. hartwegi
P. formosana
Pinus oocarpa
P. rudis
P. lambertiana
P. strobus var. chiapensis
P. parviflora
P. michoacana var. cornutu
P. yunnanensis
P. tabulaeformis
P. holfordiana x P. parviflora
P. thunbergi
P. flexilis var. reflexa
P. pinaster
P. nigra var. cebennensis
P. armandi

Pinus halepensis
P. engelmanni
P. gerardiana
P. massoniana
P. arizonica
P. coulteri
P. jeffreyi
P. excelsa
P. contorta
P. attenuata
P. insularis
P. ponderosa

Pinus hunnewelli (P. strobus x P. parviflora)
P. ayacahuite var. brachyptera
P. modoomata (P. densiflora x P. thunbergi)
P. pseudostrobus var. estevezi
P. coulteri x P. jeffreyi (natural hybrid)
P. rigida x P. taeda
P. attenuradiata (P. attenuata x P. radiata)
P. resinosa
P. longifolia
Eucalyptus spp.
Acacia spp.

West Virginia Pulp and Paper Co., Westvaco Expt. Forest, Georgetown, S.C.:
Araucaria angustifolia
Cupressus arizonica
Pinus radiata. 1951
P. radiata x P. attenuata. Hybrid. California
Metasequoia glyptostroboides. China. 1950
Populus hybrids
Sequoia sp.

STUDIES OF RACIAL VARIATION

It has been established that races varying in vigor, disease resistance, and cold resistance occur in some species of southern pines. This poses a problem to those responsible for collecting the seed from which 200 million or more seedlings are grown each year. Where shall seed be collected? If there is a short seed crop in one State, can supplementary seed be obtained from others? To provide answers to these questions for immediate use, and also to provide data for future selective breeding work is the purpose of current studies of the variation within species of southern pines and hardwoods.

College of Agriculture, Univ. of Arkansas, Fayetteville, Ark.:
Pinus taeda, P. echinata, and Juniperus virginiana from 4 locations within the State. Established 1952.

Committee on Southern Forest Tree Improvement, Subcommittee on Geographic Source of Seed:
Arranged with 25 agencies, in fall of 1951, the collection of Pinus palustris from 11 sources in 8 states; P. caribaea from 6 sources in 5 states; P. taeda from 15 sources in 10 states; and P. echinata from 15 sources in 12 states. Outplanting at approximately 60 locations in 16 states is planned for 1952-1953.

Division of Forest Pathology, Bureau of Plant Industry, Soils, and Agricultural Engineering, U.S.D.A.:

Pinus echinata from all Southern states throughout range. To be planted in 1952. (Athens, Ga.)

Pinus caribaea from North Florida, South Florida, and Mississippi. Planted in 1949. (Harrison Expt. Forest, Saucier, Miss.)

Pinus taeda, 6 sources, North Carolina to Louisiana. Planted in 1951. (W. W. Ashe Nursery, Brooklyn, Miss.)

Pinus caribaea, 6 sources, South Carolina to Louisiana. Planted in 1948.

P. caribaea, South Florida, North Florida, Mississippi, and Cuba. Planted in 1949. (Chickasawhay Ranger District, Miss. Nat'l Forest; State College, Miss.; and Santee Expt. Forest, Charleston, S. C.)

Forestry Department, Alabama Polytechnic Institute, Auburn, Ala.:

Adaptation of Florida slash pine. Established in 1935.

Northeastern Forest Experiment Station, Upper Darby, Pa.:

Fraxinus americana and F. pennsylvanica of southern and northern sources. Planted in 1940. (Harvard Forest, Petersham, Mass.) New racial plantings made in 1951 and 1952 at Williamstown, Mass., and Beltsville, Md.

Acer rubrum of different geographic sources.

Pennsylvania Department of Forests and Waters, Harrisburg, Pa.:

Pinus echinata, Tennessee, Arkansas, Texas, Louisiana, Mississippi, and South Carolina. Planted in 1935.

Southeastern Forest Experiment Station, Asheville, N. C.:

Pinus taeda, 9 sources. Planted in 1950. (Calhoun Expt. Forest, Union, S. C., in cooperation with TVA)

Pinus taeda and P. echinata, 5 sources of each. Planted in 1945. (Lee Experimental Forest, Buckingham, Va.)

Pinus resinosa from Vermont, Michigan, and Minnesota. Planted in 1926. (Bent Creek Expt. Forest, Asheville, N. C.)

Pinus glabra, Mississippi and local source. Planted in 1952. (Santee Experimental Forest, Charleston, S. C.)

Southern Forest Experiment Station, New Orleans, La.:

Pinus taeda from Georgia, Arkansas, Texas, and Louisiana. Planted in 1927. (Bogalusa, La.)

Pinus taeda, 12 sources; P. caribaea, 7 sources; P. echinata, 14 sources. Planted in 1937. (Jasper, Texas, and Athens, Ga.)

Pinus palustris seed from good and poor sites collected in 1947 and 1948; stock of all four sources outplanted on both National Forests in 1948-49 and 1949-50. (Talladega Nat'l Forest, Ala., and DeSoto Nat'l Forest, Miss.)

Pinus taeda from 9 sources. 1950. In cooperation with TVA. (Birmingham, Ala., Harrison, Ark., and Oxford, Miss.)

Tennessee Valley Authority, Norris, Tenn.:

Castanea, timber type species planted; selected and hybrid blight resistant strains. Established 1946-1951. (U.S.D.A. in cooperation with TVA, Norris Tenn., and at 10 other locations.)

Juglans nigra, 10 sources based on kernel content. Established 1940. (Norris, Tenn.)

Juniperus virginiana, 12 seed sources; established 1950. (Planted at 3 locations in Tenn.)
Rhammus purshiana, 1 source; established 1948. (Norris, Tenn.)
Robinia pseudoacacia, 3 sources; established 1938-39. (Planted at 170 locations in Tennessee Valley.)
Pinus, many geographic sources. Proposed planting locations: (Cullman Co., Ala., and Morgan Co., Tenn. Southern Forest Experiment Station in cooperation with TVA.)

Texas Forest Service, College Station, Texas:
Pinus taeda from 10 sources within the State and 2 from Louisiana were planted in Post Oak region in 1952.

University of Virginia, Blandy Experimental Farm, Boyce, Va.:
Fraxinus and Acer of several races. Also, Quercus species and known and putative hybrids.

PROJECTS IN SELECTION AND HYBRIDIZATION

Selection of genetically superior individual trees or superior races within a species permits use of the best combination of traits that occur in nature. Controlled breeding of selected individuals combines traits in still better combinations--combinations that would perhaps never occur under natural conditions. This permits further selection and breeding. Also, crosses of certain species may have hybrid vigor, with growth superior to both parents. Selective breeding or aimed breeding should create trees of higher value for all-around forest planting, or trees of greater utility for certain products. These benefits may be achieved through greater vigor, improved tree form, better wood, reduced loss from climatic factors, and smaller losses from diseases or insects. To obtain these benefits is the objective of tree breeders in the South. Most of the projects are using the direct approach by applying principles used successfully with other crop plants. There is great need for studies to develop principles based on the fundamental life processes of local species of pines and hardwoods.

Ida Cason Callaway Foundation, Hamilton, Ga.:
Pinus caribaea, P. palustris, P. echinata, and P. taeda - Large-scale selection of superior phenotypes and one-parent progeny tests with 4 major species of pine. Limited intra- and interspecific hybridization of selected trees. Observation block of P. echinata x P. taeda hybrid established in the spring of 1951.

Division of Forest Pathology, Bureau of Plant Industry, Soils and Agricultural Engineering, U.S.D.A.:
A project has been started in selection and propagation of Pinus echinata resistant to littleleaf disease. (Athens, Ga.)

Selection, hybridization, and vegetative propagation of Albizzia julibrissens resistent to mimosa wilt. (Asheville, N. C.)
Pinus caribaea from Cuba, British Honduras, South Florida, and other points within the natural range are tested for racial variation in resistance to fusiform rust. (Harrison Expt. Forest, Saucier, Miss.)
Open-pollinated seed was collected from disease-free Pinus caribaea as well as from diseased parents in areas of high rust incidence to test for disease resistance in one-parent progeny. Seedlings were planted in 1946 and 1947. A similar test with both P. caribaea and P. taeda seed from Mississippi and Georgia was established in 1947. (W. W. Ashe Nursery, Brooklyn, Miss.)
Selection of disease-free Pinus palustris from unsprayed nursery beds will be made in fall of 1951 in a test for resistance to brown spot needle blight. (W. W. Ashe Nursery, Brooklyn, Miss.)

Forestry Department, Ala. Polytechnic Institute, Auburn, Ala.:
Test of several Pinus taeda x P. echinata crosses of different geographic sources in comparison with parent species.. Seed was supplied by the Institute of Forest Genetics.

Georgia Experiment Station, Experiment, Ga.:
One-parent progeny tests of selected southern pines and hybridization of superior trees.

Mississippi Agricultural Experiment Station, College Station, Miss.:
Pinus taeda x P. echinata backcrossed to each of parent species to compare survival, growth rate, and form of hybrid with each species.

Northeastern Forest Experiment Station, Upper Darby, Pa.:
Many interspecific hybridizations within recent years in Fraxinus, Acer, Liriodendron, and Quercus. Also, in Pinus, in the series Strobi, Lariciones, and Insignes.
Pinus rigida x P. taeda and P. echinata x P. rigida hybrids were planted at the Eastern Shore Expt. Forest in Maryland and at the Lebanon State Forest in New Jersey in 1945, being grown from seed produced at the Institute of Forest Genetics.

Southeastern Forest Experiment Station, Asheville, N. C.:
Selection, intra- and inter-specific hybridization, and propagation of Pinus caribaea and P. palustris selected on the basis of superior oleoresin production. Two plantations have been established (1946 and 1950) of species hybrids, and intra-crosses among high, average, and low, gum-yielding P. caribaea. (Olustee Expt. Forest, Lake City, Fla.)
A plantation of Pinus echinata x P. taeda hybrid and seed of same species from various sources was established in 1951. Seed of hybrid stock was provided by the Institute of Forest Genetics. (Hitchiti Expt. Forest, Macon, Ga.)
A test plantation with Pinus monticola x P. strobus and P. rigida x P. taeda was established in 1951. Seed was provided by the Institute of Forest Genetics. (Bent Creek Expt. Forest, Asheville, N. C.)
Seedlings of Pinus rigida x P. taeda hybrid and P. taeda from several sources were planted in 1945. (Lee Expt. Forest, Buckingham, Va.)

Southern Forest Experiment Station, New Orleans, La.:

Planting of a hybrid from controlled pollination in 1929 of Pinus palustris x P. caribaea and a cross in 1931 of P. sondereggeri x P. palustris. Single tree of each cross. (Bogalusa, La.)

Limited interspecific hybridization of southern pines in 1951 and 1952. (Alexandria, La., Branch Station)

Outplantings of hybrids in 1948-49 of Pinus taeda x P. echinata crosses and back-crosses. Seed was from the Institute of Forest Genetics. (Branch Station at Birmingham, Ala., the Ozark at Harrison, Ark., and Tallahatchie at Oxford, Miss.)

Limited interspecific hybridization of southern pines in 1951. (Gulfcoast Branch Station, Gulfport, Miss.)

Outplanting in 1952 of progenies from wind pollination of 7 individuals of Pinus sondereggeri and of one presumed natural P. palustrix x P. caribaea cross. (Many, La. In cooperation with A. J. Hodges Industries, Inc., and Agricultural Experiment Station and School of Forestry, Louisiana State University.)

Tennessee Valley Authority, Norris, Tenn.:

Castanea mollissima, Carya illinoensis, Carya ovata, and Carya hybrids, Corylus americana, Corylus avellana, and Corylus hybrids - Objective: To test the performance of superior selections in the Tennessee Valley. Test plantings have been established at numerous locations to compare variety performance under varying conditions. Project in cooperation with Alabama, Georgia, Kentucky, Tennessee and Virginia Agricultural Experiment Stations.

Pinus taeda, P. echinata, P. strobus - Selection of genetically superior seedlings found in TVA forest tree nurseries. Growth of these "superseedlings" compared with average seedlings.

Acer, Betula, Juglans, Liriodendron species - Methods of inducing figured wood. Seedlings of these four species were given several abnormal treatments as a means of inducing formation of figured wood.

Texas Forest Service, College Station, Texas:

Pinus taeda, P. palustris, P. echinata, P. caribaea - Selection of superior phenotypes on the basis of the best silvical and wood characters possible with special emphasis on those characters known, or strongly suspected of being, strictly controlled genetically. Tests with open pollinated progeny of selected trees and later with vegetatively propagated material. Hybridization of selected trees and tests of new equipment for controlled breeding.

University of Arkansas Experiment Station, Hope, Ark.:

Pinus taeda, P. echinata - Comparison of progeny from superior and average parents.

West Virginia Pulp and Paper Co., Westvaco Expt. Forest, Georgetown, S.C.:

Pinus taeda - Trees on two 5-acre seed orchards were selected as mother trees to provide seed for local planting. Forty-four trees 10-20 years have been selected and treatments to stimulate seed production have been applied. One-parent progeny tests have been initiated.

STUDIES IN VEGETATIVE PROPAGATION

Vegetative propagation as opposed to sexual propagation permits endless multiplication of superior plants with identical genetic constitution. Foresters may wish to propagate certain valuable trees, just as horticulturists do with fruit and nut trees. For immediate use tree breeders would like to establish plantations of grafted stock or rooted cuttings to be used in controlled breeding and, in some instances, to produce seed of superior strains in volume. Although some species have been propagated successfully by graftage or cuttage, refinement of techniques is needed to increase the percentage of success and to make the field work easier. Cuttings of chestnut, for instance, have never been successfully rooted. Thousands of slash pine cuttings were treated before the first one was successfully rooted a few years ago.

Division of Forest Pathology, Bureau of Plant Industry, Soils and Agricultural Engineering, U.S.D.A.:
Pinus echinata, methods of grafting. (Athens, Ga.)
Albizzia julibrissens, methods of vegetative propagation. (Asheville,N.C.)

Forestry Department, Alabama Polytechnic Institute, Auburn, Ala.:
Cupressus arizonica, grafting and rooting of cuttings.

Southeastern Forest Experiment Station, Asheville, N. C.:
Liquidambar styraciflua, rooting of cuttings. (Charleston, S. C.)
Pinus caribaea and P. palustris, grafting. (Lake City, Fla.)

Tennessee Valley Authority, Norris, Tenn.:
Acer, Betula, Carya, Castanea, Corylus, Diospyros, Gleditsia, Liriodendron, Morus, Robinia, Populus, budding, grafting, root and stem cuttings.

Texas Forest Service, College Station, Texas:
Grafting many introduced species and hybrids on local species stock.

West Virginia Pulp and Paper Co., Westvaco Expt. Forest, Georgetown, S. C.:
Mestasequoia glyplostroboides, rooting of cuttings.

STUDIES IN CYTOLOGY AND METHODS OF INDUCING MUTATIONS

A knowledge of chromosome number in all important tree species and varieties is essential to the plant breeder. Also, he should have accurate data for chromosome pairing if hybrids are to be accurately evaluated, because incomplete pairing may cause sterility. Cytological work is essential in the

study of mutations whether they occur naturally or are artificially induced. Changes in the chromosomes through mutation may produce radically different plants that are essentially new species. Some commercially important fruit trees such as certain grapefruit varieties are mutants. The characteristics of mutant forest trees, especially southern species, are practically unknown, although selection of these unusual trees may be quite profitable.

Georgia Experiment Station, Experiment, Ga.:
Pinus taeda - Cooperative tests with Harvard University of characteristics of irradiated seed.

Northeastern Forest Experiment Station, Upper Darby, Pa.:
Fraxinus americana - Observation plots of natural occurring polyploids obtained in studies of racial variation.

Southeastern Forest Experiment Station, Asheville, N. C.:
Pinus taeda, P. clausa, P. echinata, Liquidambar styraciflua - Cooperative tests with Harvard University of characteristics of irradiated seed.

University of Virginia, Blandy Expt. Farm, Boyce, Va.:
Chromosome number and phylogeny in conifers.

STUDIES IN STIMULATING SEED PRODUCTION

Selectively breeding several generations of forest trees requires a long time unless they reach sexual maturity at a very early age. Therefore, any techniques to bring about flowering in very young trees is of great practical use to the tree breeder. And, it is important that a large number of flowers be produced. Techniques for stimulating production of seed would have widespread application in seed-orchard management. Grafting twigs of mature trees onto seedlings or grafting twigs of juvenile hybrids to branches of mature trees has increased seed production in certain pine species. Also, root pruning of seedlings, strangulation, partial girdling, and the application of plant nutrients have been successful. Similar or improved techniques are needed for southern forest tree species.

Division of Forestry, North Carolina Department of Conservation and Development, Raleigh, N. C.:
Pinus taeda - Improvement cuts in 50-year-old stand to stimulate seed production.

Southeastern Forest Experiment Station, Asheville, N. C.:
Pinus taeda - Studies in effect of release from the side; two levels of fertilization, and partial girdling on volume and quality of seed. Franklin, Va.

Southern Forest Experiment Station, New Orleans, La.:

Pinus palustris, tests to increase seed production. Brewton, Ala., Branch Station.

Pinus taeda, tests of thinning, strangulation, and ringing to increase seed production. Crossett, Ark., Branch Station.

Pinus palustris, tests of fertilizing and of banding branches to increase seed production. Gulfcoast Branch Station, Gulfport, Miss.

West Virginia Pulp and Paper Co., Westvaco Experimental Forest, Georgetown, S. C.:

Pinus taeda, release and isolation of 10 to 20-year-old trees. Tests of topping and banding to stimulate seed production.

ORGANIZATIONS CONDUCTING WORK IN TREE IMPROVEMENT

The opportunity for increasing yields of forest products through use of more vigorous species and improved strains, races, or hybrids of local species in planting programs has already stimulated considerable interest in forest genetics on the part of industries and public agencies. And it is only beginning. There is also a growing appreciation of the need for maintaining good genetic quality in natural stands through the use of sound timber-cutting practices. Studies in forest genetics will influence and be influenced by studies of forest soils, silviculture, forest management and utilization. As the following list indicates, work on the genetic improvement of southern forest trees is now under way by private industries, a private foundation, state forest services, forestry schools, agricultural experiment stations, regional forest experiment stations, and several other federal agencies. The projects are designed to meet the needs of these widely varied interests.

A. J. Hodges Industries, Inc., Shreveport, La.:

1. Has entered into formal contract with Agricultural Experiment Station and School of Forestry, Louisiana State University, to conduct research in forest genetics on fenced tract of cut-over longleaf pine land at Many, La.; is reserving 100 acres on tract for Southern Forest Experiment Station's breeding stock and progeny tests.

Arkansas Resources and Development Commission, Division of Forestry and Parks, Little Rock, Arkansas, and Univ. of Arkansas, Fayetteville, Ark.:

1. Studies of racial variation in Pinus taeda, P. echinata, and Juniperus virginia.
2. Comparison in growth of trees from Pinus taeda and P. echinata seed collected from plus trees and from average trees.

Department of Forestry, Oklahoma Agricultural Expt. Sta., and Oklahoma State Division of Forestry, Oklahoma City, Okla.:

1. Adaptation tests of Pinus thunbergi, P. densiflora, P. massoniana, and many other species.

Division of Forest Pathology, Bureau of Plant Industry, Soils and Agricultural Engineering, U.S.D.A.:

1. Studies of racial variation in Pinus echinata in resistance to littleleaf disease, and selective breeding of P. echinata for resistance to littleleaf disease. Athens, Ga.
2. Studies of racial variation in Pinus caribaea in resistance to fusiform rust and in P. palustris to brown spot disease. Saucier, Miss.
3. Selection, vegetative propagation and control breeding with mimosa for increasing resistance to mimosa wilt. Asheville, N. C.
4. Studies of racial variation in Pinus taeda. Brooklyn, Miss.

Florida Forest Service, Tallahassee, Fla.:

1. Adaptation tests of many tropical tree species for planting in South Florida.

Forestry Department, Alabama Polytechnic Institute, Auburn, Ala.:

1. Test of Pinus caribaea from Florida for planting in local area. Also, P. echinata and P. taeda from other states.
2. Tests of Pinus echinata x P. taeda hybrid with parent species in cooperation with Institute of Forest Genetics.
3. Techniques for vegetative propagation of Arizona cypress.
4. Cooperation with other agencies wishing to have custom-grown nursery stock produced from their own seed for planting on their areas.

Ida Cason Callaway Foundation, Hamilton, Ga.:

1. Selection and one-parent progeny tests of Pinus caribaea, P. palustris, P. taeda; and P. echinata.
2. Inter- and intra-specific crosses of selected trees of 4 major species of southern pine.
3. Selection of races of 4 major southern pines best suited to west-central Georgia.
4. Tests of introduced species.

Institute of Forest Genetics, Placerville, Calif.:

1. Controlled breeding of major southern pines.
2. Development of equipment and techniques for controlled breeding.
3. Studies in inheritance of characters in certain pines and other studies in field of forest genetics.

North Carolina Department of Conservation and Development, Division of Forestry, Raleigh, N. C.:

1. Test of Pinus pinaster for ocean beach planting.
2. Production of seed in a natural 50-year-old P. taeda stand developed

as a seed orchard by selecting and releasing the better trees.
3. Tests of methods and equipment for collecting cones and seed from standing trees.
4. Plus-tree selection by employees preparatory to conducting progeny tests.

Northeastern Forest Experiment Station, Upper Darby, Pa.:
1. Studies of racial variation in Fraxinus americana, F. pennsylvanica, and Acer rubrum.
2. Selection and controlled breeding of Fraxinus, Acer, Liriodendron, Pinus, and Quercus.
3. Testing of Pinus rigida x P. taeda and P. echinata x P. rigida hybrids in cooperation with Institute of Forest Genetics.
4. Development of equipment and techniques for controlled breeding.

Queensland Forest Service, Brisbane, Australia:
1. Studies of progeny after wind pollination of superior Pinus caribaea and P. taeda phenotypes.
2. Selection and controlled breeding for vigor and improved wood quality in Pinus caribaea, P. taeda, and other species.
3. Vegetative propagation of Pinus caribaea and P. taeda.

School of Forestry, University of Florida, Gainesville, Florida:
1. Examination of plantations of known seed source for information on racial strains of slash and longleaf pine.
2. Investigation on vegetative propagation.
3. Establishment of ecotype plantations of longleaf and slash pine for propagating and breeding material.
4. Establishment of seed source plantations to demonstrate variations due to geographic origin.
5. Breeding slash and longleaf pine for vigor and form.

Southeastern Forest Experiment Station, Asheville, N. C.:
1. Studies of racial variation in Pinus taeda, P. echinata, and adaptability test of P. rigida x P. taeda hybrid. Buckingham, Va.
2. Adaptability tests of many coniferous species; also, Pinus monticola x P. strobus hybrid and P. rigida x P. taeda hybrid.
3. Limited study of racial variation in Pinus taeda and P. echinata and adaptability of P. echinata x P. taeda hybrid. Macon, Ga.
4. Vegetative propagation and selective breeding of Pinus caribaea and P. palustris to improve production of oleoresin and timber products. Lake City, Fla.

Southern Forest Experiment Station, New Orleans, La.:
1. Studies of racial variation in P. taeda. Bogalusa, La.
2. Studies of racial variation in vigor and resistance to disease in P. caribaea, P. taeda, P. echinata, and P. palustris. Cooperative studies located at Athens, Ga., Andulusia, Ala., and Lufkin, Texas.
3. Limited individual tree selection and controlled pollination of Pinus caribaea, P. taeda, P. palustris, P. echinata, at Alexandria, La., same less P. echinata at Gulfport, Miss., and Bogalusa, La.

4. Organizational responsibility for the 1951 South-wide study of racial variation in 4 major species of southern pine, in cooperation with the Committee on Southern Forest Tree Improvement.

Tennessee Valley Authority, Norris, Tenn.:

1. Adaptation test plantings of Castanea, Carya, and Corylus species under varying conditions.
2. Nursery selection of Pinus taeda, P. echinata, and P. strobus seedlings.
3. Studies in methods of inducing figured wood in Acer, Betula, Juglans, and Liriodendron species.
4. Vegetative propagation of numerous hardwood genera.
5. Studies of racial variation in Pinus taeda, Juglans nigra, Juniperus virginia, Rhammus purshiana, and Robinia pseudoacacia.
6. Plantings of foreign tree species to test adaptability or to serve as a source of pollen or seed.

Texas Forest Service, College Station, Texas:

1. Studies of racial variation in local Pinus taeda.
2. Selection and hybridization of selected Pinus taeda, P. palustris, P. echinata, and P. caribaea.
3. Tests of nursery bed selection of Pinus taeda, P. caribaea, and P. echinata.
4. Adaptation planting of many foreign species and hybrids.
5. Vegetative propagation of forest trees.
6. Phenological observations of four major southern pines.

University of Virginia, Blandy Experimental Farm, Boyce, Va.:

1. Studies of chromosome number and phylogeny in the conifers.
2. Studies of natural hybridity in the oaks.
3. Studies of racial variation in ash and maple.

West Virginia Pulp and Paper Company, Georgetown, S. C.:

1. Seed orchard in natural stand of Pinus taeda.
2. One-parent progeny tests with P. taeda.
3. Stimulation of seed production in P. taeda.
4. Tests of a few introduced species.